PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
Case 00052.2		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/EP 00/ 01850	03/03/2000	05/03/1999

Applicant

GREENOVATION PFLANZENBIOTECHNOLOGIE GMBH

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 2

   [X] as suggested by the applicant.

   [ ] None of the figures.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

INTERNATIONAL SEARCH REPORT

International Application No
CT/EP 00/01850

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C12N15/52 C12N15/53 C12N15/82 C12N5/10 A01H5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C12N A01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, BIOSIS, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 872 554 A (HOFFMANN LA ROCHE) 21 October 1998 (1998-10-21) the whole document ---	1,11
X	BARTLEY GLENN E ET AL: "Two Arabidopsis thaliana carotene desaturases, phytoene desaturase and zeta-carotene desaturase, expressed in Escherichia coli, catalyze a poly-cis pathway to yield pro-lycopene." EUROPEAN JOURNAL OF BIOCHEMISTRY, vol. 259, no. 1-2, January 1999 (1999-01), pages 396-403, XP000925505 ISSN: 0014-2956 the whole document --- -/--	1,11

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 July 2000	07/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Kania, T

1

Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 36717 A (CENTRE NAT RECH SCIENT ;KUNTZ MARCEL (GB)) 21 November 1996 (1996-11-21) the whole document	1-3,6,7, 9,11,12
X	US 5 539 093 A (FITZMAURICE WAYNE P ET AL) 23 July 1996 (1996-07-23) the whole document	1-3,7, 11-16, 18-20
X	MISAWA N ET AL: "EXPRESSION OF AN ERWINIA PHYTOENE DESATURASE GENE NOT ONLY CONFERS MULTIPLE RESISTANCE TO HERBICIDES INTERFERING WITH CAROTENOID BIOSYNTHESIS BUT ALSO ALTERS XANTHOPHYLL METABOLISM IN TRANSGENIC PLANTS" PLANT JOURNAL,GB,BLACKWELL SCIENTIFIC PUBLICATIONS, OXFORD, vol. 6, no. 4, 1994, pages 481-489, XP002012919 ISSN: 0960-7412 the whole document	1-3,7, 10-16, 18-20
X	WO 98 06862 A (SHEWMAKER CHRISTINE K ;CALGENE INC (US)) 19 February 1998 (1998-02-19) cited in the application see the whole document; esp. examples	1-20
X	WO 99 07867 A (CALGENE LLC) 18 February 1999 (1999-02-18) see the whole document; esp. examples	1-20
X	WO 91 13078 A (AMOCO CORP) 5 September 1991 (1991-09-05) cited in the application see the whole document; esp. ex.18	1-3,5, 7-20
A	BURKHARDT ET AL: "Transgenic rice (Oryza sativa) endosperm expressing daffodil (Narcissus pseudonarcissus) phytoene synthase accumulates phytoene, a key intermediate of provitamin A biosynthesis" PLANT JOURNAL,GB,BLACKWELL SCIENTIFIC PUBLICATIONS, OXFORD, vol. 11, no. 5, 1997, pages 1071-1078, XP002087151 ISSN: 0960-7412 cited in the application see the whole document; esp. last paragraph	1-20

-/--

1

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 96 13149 A (AMOCO CORP) 9 May 1996 (1996-05-09) cited in the application the whole document	1-20
A	US 5 705 624 A (KUMAGAI MONTO HIROSHI ET AL) 6 January 1998 (1998-01-06) the whole document	1-20
A	AL-BABILI S. ET AL.: "Narcissus lycopene cyclase cDNA; AC X98796" EBI DATABASE, 4 July 1996 (1996-07-04), XP002143214 the whole document	1,2,6,9
P,X	YE, XUDONG ET AL: "Engineering the provitamin A (.beta.- carotene) biosynthetic pathway into (carotenoid -free) rice endosperm" SCIENCE (WASHINGTON, D. C.) (2000), 287(5451), 303-305 , XP002143215 the whole document	1-20

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0872554 A	21-10-1998	BR 9705676 A	25-05-1999
		CN 1184159 A	10-06-1998
		JP 10155497 A	16-06-1998
WO 9636717 A	21-11-1996	AU 5897796 A	29-11-1996
US 5539093 A	23-07-1996	NONE	
WO 9806862 A	19-02-1998	AU 4058497 A	06-03-1998
		CN 1227609 A	01-09-1999
		EP 0925366 A	30-06-1999
WO 9907867 A	18-02-1999	AU 8900298 A	01-03-1999
		EP 1002117 A	24-05-2000
WO 9113078 A	05-09-1991	CA 2055447 A	03-09-1991
		EP 0471056 A	19-02-1992
		JP 5504686 T	22-07-1993
		US 5545816 A	13-08-1996
		US 5530188 A	25-06-1996
		US 5530189 A	25-06-1996
		US 5684238 A	04-11-1997
		US 5618988 A	08-04-1997
		US 5656472 A	12-08-1997
WO 9613149 A	09-05-1996	US 5618988 A	08-04-1997
		AU 697358 B	01-10-1998
		AU 3970195 A	23-05-1996
		CA 2203815 A	09-05-1996
		CN 1172416 A	04-02-1998
		EP 0792352 A	03-09-1997
		JP 10509309 T	14-09-1998
		NO 971945 A	27-06-1997
		NZ 296012 A	28-05-1999
		PL 319788 A	01-09-1997
US 5705624 A	06-01-1998	NONE	

PATENT COOPERATION TREATY

PCT/EP00/01850

From the INTERNATIONAL BUREAU

PCT

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:
JOACHIM STÜRKEN
PATENTANWALTSGESELLSCHAFT MBH
Engesserstrasse 4b
D-79108 Freiburg im Breisgau
ALLEMAGNE

EINGEGANGEN
25. Sep. 2000
Joachim Stürken
Patentanwaltsgesellschaft mbH

Date of mailing (day/month/year) 14 September 2000 (14.09.00)	
Applicant's or agent's file reference Case 00152.2	IMPORTANT NOTICE

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/EP00/01850	03 March 2000 (03.03.00)	05 March 1999 (05.03.99)

Applicant
GREENOVATION PFLANZENBIOTECHNOLOGIE GMBH et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
   AU,KR,KR,US

   In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
   AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CN,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW
   The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
   14 September 2000 (14.09.00) under No. WO 00/53768

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

Form PCT/IB/308 (July 1998)

Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

Date of mailing (day/month/year)	IMPORTANT NOTICE
14 September 2000 (14.09.00)	
Applicant's or agent's file reference	**International application No.**
Case 00052.2	PCT/EP00/01850

The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
Case 00052.2		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/01850	03/03/2000	05/03/1999
International Patent Classification (IPC) or national classification and IPC C12N15/52		
Applicant GREENOVATION PFLANZENBIOTECHNOLOGIE GMBH		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
28/09/2000	02.07.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Barnas, C Telephone No. +49 89 2399 7469

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/01850

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-31	as originally filed				

Claims, No.:

1-18	as received on	07/06/2001	with letter of	07/06/2001	

Drawings, sheets:

1-5	as originally filed				

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)
   see separate sheet

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-18
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-18
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations
   see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

R It m I

Basis of th r port

The specification provides support for the amended set of claims as far as referring to two enzymes being plant or fungi phytoene synthase and fungi or bacteria phytoene desaturase (p. 8, ln. 25-28). The amended claims, however, are not supported as far as referring to the specific combination of phytoene synthase with phytoene desaturase and ζ-carotene desaturase. Thus, this combination of enzymes which is described in amended claims 1, 2 and 14 goes beyond the disclosure as filed and has, therefore, been disregarded while establishing this report (Rule 70.2(c) PCT).

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

D1: WO 99 07867 A (CALGENE LLC) 18 February 1999 (1999-02-18)

D2: BURKHARDT ET AL: 'Transgenic rice (Oryza sativa) endosperm expressing daffodil (Narcissus pseudonarcissus) phytoene synthase accumulates phytoene, a key intermediate of provitamin A biosynthesis' PLANT JOURNAL,GB,BLACKWELL SCIENTIFIC PUBLICATIONS, OXFORD, vol. 11, no. 5, 1997, pages 1071-1078, XP002087151 ISSN: 0960-7412 cited in the application

Art. 33(3) PCT, Inventive Step

1. D1 is the closest prior art document for the present application. Said document (p. 28, ln. 21-p. 29, ln. 19) discloses plasmids which contain a napin expression cassette for the bacterial phytoene desaturase fused to the transit peptide sequence of the pea Rubisco small subunit and bacterial phytoene synthase. The napin expression cassette contains a promoter preferentially expressed in plant seed tissue (p. 50, ln. 1-4). Said plasmids represent binary vectors for Agrobacterium-mediated transformation. The plasmids were used for the production of transgenic Brassica napus plants (p. 32, ln. 7-9 p. 41, ln. 31 - p. 44, ln. 2). The seeds of these transgenic plants show increased carotenoid levels.

1.2. The difference between claims 1-13 and D1 is the use of a phytoene synthase derived from plant or fungi instead of bacteria. The use of such phytoene synthases would,

however, be obvious for the skilled person because such enzymes are known and used for plant transformation (see e.g. p. 4, ln. 2-3 of the specification and p. 5, ln. 8-10 of D1). Also the use of hygromycin phosphotransferase as a marker gene is obvious because such a marker gene is used for plant transformation in the prior art (see D2, p. 1072, right column, paragraph 2). **Claims 1-13 and 17** are, therefore, not inventive.

2. The wording of claim 1 embraces DNA molecules which also comprise a phytoene synthase and a phytoene desaturase in addition to ζ-carotene desaturase and lycopene cyclase. Such DNA molecules are, however, obvious in the light of D2: said document discloses the production of transformed rice endosperm with a vector which expresses daffodil phytoene synthase (p. 1072, right column, paragraph 2). D2 further refers to experiments to transform rice plants with the remaining enzymes needed to produce β-carotene in rice endosperm (p. 1075, right column, last paragraph). In view of the obvious need for such plants (see introduction of D2) the skilled person would follow the teaching of D2 and produce a DNA molecule as embraced in claim 1 and use it for methods as embraced in claims 14-18. **Claims 1 and 14-18** are because of this reason not inventive.

Re Item VIII
Certain observations on the international application

Art. 6 PCT, Lack of Clarity, Lack of Conciseness

1. Claim 8 refers to "said plastid transit peptide sequence" of the DNA molecule of claim 7. Claim 7, however, does not describe a plastid transit peptide sequence.

2. Claim 14 describes transformation with plasmids or vector systems according to claim 9 or 10 or with plasmids or vector systems carrying genes or cDNAs coding for phytoene synthase desaturase. The systems according to claim 9 or 10, however, already carry genes or cDNAs coding for phytoene synthase desaturase. Thus claim 14 unduly repeats the same subject matter and is, therefore, not concise.

3. According to the teaching of claim 17, Brassica seeds are carotenoid free. D1, however, shows that said seeds contain carotenoids. Thus, claim 17 is inherently inconsistent and, therefore, not clear.

Claims:

1. An isolated DNA molecule comprising a nucleotide sequence providing one or more expression cassettes capable of directing production of two or three enzymes specific for the carotenoid biosynthesis pathway being:
   - phytoene synthase derived from plants or fungi, and
   - phytoene desaturase derived from fungi or bacteria, or
   - phytoene desaturase and ζ-carotene desaturase derived from plants.

2. The DNA molecule according to claim 1, wherein said expression cassette comprises genes or cDNAs coding for plant or fungi phytoene synthase, for fungi or bacterial phytoene desaturase or for plant phytoene desaturase and ζ-carotene desaturase, each operably linked to a suitable constitutive, inducible or tissue-specific promoter allowing its expression in plant cells, seeds, tissues or whole plants.

3. The DNA molecule according to claim 1 or 2, further comprising at least one selectable marker gene or cDNA operably linked to a constitutive, inducible or tissue-specific promoter sequence allowing its expression in plant cells, seeds, tissues or whole plants.

4. The DNA molecule according to any of claims 1 to 3, wherein the nucleotide sequence coding for phytoene synthase originates from plants, preferably expressed under the control of a tissue-specific promoter.

5. The DNA molecule according to any of claims 1 to 4, wherein the nucleotide sequence coding for phytoene desaturase originates from bacteria.

6. The DNA molecule according to any of claims 1 to 5, wherein the nucleotide sequence coding for phytoene desaturase is fused with a suitable plastid transit peptide encoding sequence, both of which preferably are expressed under the control of a tissue-specific or constitutive promoter.

7. The DNA molecule according to any of claims 2 to 6, wherein the selectable marker gene or cDNA is hygromycin phosphotransferase under the control of a constitutive promoter.

8. The DNA molecule according to claim 6 or 7, wherein said plastid transit peptide sequence is derived from the pea Rubisco small subunit (tp).

9. A plasmid or vector system comprising the DNA molecules according to any of claims 1 to 8.

10. A plasmid or vector system according to claim 9, which is derived from *Agrobacterium tumefaciens*.

11. A transgenic plant cell, seed, tissue or whole plant that contains a DNA molecule according to any of claims 1 to 8.

12. A transgenic plant cell, seed, tissue or whole plant according to claim 11, selected from the group consisting of eukaryotic alga, embryophytes comprising *Bryophyta*, *Pteridophyta* and Spermatophyta such as *Gymnospermae* and *Angiospermae*, the latter including *Magnoliopsida*, *Rosopsida*, and *Liliopsida* ("monocots").

13. A transgenic plant cell, seed, tissue or whole plant according to claim 12, selected from the group consisting of grain seeds, with rice, wheat, barley, oats, amaranth, flax, triticale, rye, and corn being preferred; oil seeds, with *Brassica* seeds, cotton seeds, soybean, safflower, sunflower, coconut, and palm being preferred; other edible seeds or seeds with edible parts selected from the group consisting of pumpkin, squash, sesame, poppy, grape, mung beans, peanut, peas, beans, radish, alfalfa, cocoa, coffee, hemp; tree nuts, with walnuts, almonds, pecans, and chick-peas being preferred; potatoes, carrots, sweet potatoes, tomato, pepper, cassava, willows, oaks, elm, maples, apples, bananas; and ornamental flowers, with lilies, orchids, sedges, roses, buttercups, petunias, phlox, violets, and sunflowers being preferred.

14. A method of transforming plant cells, seeds, tissues or whole plants in order to yield transformants capable of expressing all enzymes of the carotenoid biosynthesis pathway necessary to produce carotenes and xanthophylls of interest, comprising the transformation of said plant cells, seeds, tissues or whole plants with a DNA molecule according to any of claims 1 to 8, or with a plasmid or vector system according to claim 9 or 10, or with plasmids or vector systems carrying genes or cDNAs coding for plant or fungi phytoene synthase and for fungi or bacterial phytoene desaturase, or with plasmids or vector systems carrying genes or cDNAs coding for plant or fungi phytoene synthase, for plant phytoene desaturase and for plant ζ-carotene desaturase, wherein said host plant cells, seeds or tissues selected for transformation normally are carotenoid-free.

15. A method according to claim 14, wherein said host plant cells, seeds or tissues selected for transformation normally have a carotenoid content of 0.001 % w/w or lower.

16. A transformed whole plant regenerated from transformants yielded according to claim 14 or 15, or parts thereof, selected from the group consisting of eukaryotic alga, embryophytes comprising *Bryophyta*, *Pteridophyta* and Spermatophyta such as *Gymnospermae* and *Angiospermae*, the latter including *Magnoliopsida*, *Rosopsida*, and *Liliopsida* ("monocots").

17. A transformed whole plant or part thereof according to claim 16, selected from the group consisting of grain seeds, with rice, wheat, barley, oats, amaranth, flax, triticale, rye, and corn being preferred; oil seeds, with *Brassica* seeds, cotton seeds, soybean, safflower, sunflower, coconut, and palm being preferred; other edible seeds or seeds with edible parts selected from the group consisting of pumpkin, squash, sesame, poppy, grape, mung beans, peanut, peas, beans, radish, alfalfa, cocoa, coffee, hemp; tree nuts, with walnuts, almonds, pecans, and chick-peas being preferred; potatoes, carrots, sweet potatoes, tomato, pepper, cassava, willows, oaks, elm, maples, apples, bananas; and ornamental flowers, with lilies, orchids, sedges, roses, buttercups, petunias, phlox, violets, and sunflowers being preferred.

18. A transformed whole plant or part thereof according to claim 17 being rice.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room 524
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 27 October 2000 (27.10.00)	
International application No. PCT/EP00/01850	**Applicant's or agent's file reference** Case 00052.2
International filing date (day/month/year) 03 March 2000 (03.03.00)	**Priority date** (day/month/year) 05 March 1999 (05.03.99)
Applicant BEYER, Peter et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

28 September 2000 (28.09.00)

[ ] *in a notice effecting later election filed with the International Bureau on:*

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	*Authorized officer* S. Mafla
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

P/ ENT COOPERATION TREA

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

JOACHIM STÜRKEN
PATENTANWALTSGESELLSCHAFT MBH
Engesserstrasse 4b
D-79108 Freiburg im Breisgau
ALLEMAGNE

Date of mailing (day/month/year)
24 August 2001 (24.08.01)

Applicant's or agent's file reference
Case 00052.2

IMPORTANT NOTIFICATION

International application No.
PCT/EP00/01850

International filing date (day/month/year)
03 March 2000 (03.03.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address
GREENOVATION
PFLANZENBIOTECHNOLOGIE GMBH
Sonnenstrasse 5
D-79104 Freiburg im Breisgau
Germany

State of Nationality: DE
State of Residence: DE
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
GREENOVATION
PFLANZENBIOTECHNOLOGIE GMBH
Bötzinger Strasse 29b
D-79111 Freiburg im Breisgau
Germany

State of Nationality: DE
State of Residence: DE
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

Authorized officer
Céline Faust
Telephone No.: (41-22) 338.83.38